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FACTORS INVOLVED IN TACTILE READING.

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by

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FACTORS INVOLVED IN TACTILE READING.

Analysis of various systems of embossed print.

In considering certain specific psychological and physiological factors involved in the process of tactile reading, we shall first describe the different systems of tangible type, especially those forms now in common use. While we have records of early sporadic attempts to teach the blind tactile reading by means of various clumsy mechanical devices, it was not until the close of the eighteenth century that tangible type, in the true sense of the term, made its appearance.¹ At this time, Valentin Haüy, whose name has become famous in the history of early education for the blind, accidentally discovered that one of his pupils could read, through the sense of touch, an ordinary Roman letter which had been embossed upon a card. From this discovery, evolved the alphabetical systems of tangible typography which were to persist for many years in Europe, and for an even greater length of time in America.

These alphabetical systems were of three main classes: (1) A form of Roman script, adopted by Haüy,

1. Best. The Blind, ch. 26.
French. Education of the Blind, Pt. 2.

and used in France for a considerable period of time.

(2) Roman characters stripped of all curves and consisting only of angular outlines. This form of embossed print was produced by James Gall² in Edinburgh and was used to some extent by the blind of Great Britain. (3) A combination of Roman capital and lower case letters, known as Boston line-letter, invented by Dr. S. G. Howe, director of the Perkins Institution for the Blind at Boston and used widely in the United States until the close of the nineteenth century. The outstanding fault of these alphabetical systems of embossed print was their foundation upon the false psychological doctrine that loss of vision results in the transference of visual qualities to the cutaneous senses. Educators of the blind felt that if their pupils were to experience a minimum degree of isolation they must learn to read by touch the same conventional symbols that others read by sight. It does not seem to have occurred to them that if seventy per cent³ of the sightless could not read "line type" the total degree of isolation was much greater than it would have been if all could read some arbitrary system of tangible print. However, the theory that "What looks well to

2 Gall. An historical sketch of the origin and progress of literature for the blind, pp. 23-88.

3. Wait. Fifty-fifth Annual Report of the New York Institution for the Blind, 1890.

the eye, must feel equally well to the touch" was soon to be exploded.

At some time during the early part of the nineteenth century Charles Barbier, a retired French army officer, determined to devote his energies to the production of a more tangible system of embossed print. He hit upon the idea that raised points or dots, are more easily discernible to the sense of touch than are embossed lines. His system consisted in the grouping of twelve points in the form of a "cell" six points high and two wide. While greater tangibility was secured by this method, the twelve-point cell was so clumsy, both for reading and embossing, that it did not meet with approval, either by the blind or by their seeing instructors.

It remained for a young Frenchman, Louis Braille a pupil at Haüy's Paris institution, to work out, and perfect Barbier's idea. He reduced the number of points in the cell to six, making it three points high, and two wide. This reduced the clumsiness without decreasing the tangibility, and, in fact, increasing it, since the tip of the reading finger could better cover the cell and thus eliminate wasteful vertical movements. In addition to the greater "readability" of this point system, it could be written with comparative ease by means of a special frame and stylus, and this of course tended to popularize it among the blind. While Braille's system was undoubtedly superior to anything which had been produced up to that time, it did not come into general use in France until 1854, two years after the

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originator's death.

In Great Britain, other arbitrary systems had been tried, such as the phonetic shorthand systems of Lucas and Frere. During the first half of the nineteenth century a condition of general confusion existed as to tangible types, certain educational institutions advocating one system, while others championed another. The formation of the British and Foreign Blind Association in 1868, under the leadership of Dr. T. R. Armitage,⁴ marked the close of the type war in the British Isles. This Association, formed entirely of blind persons, decided, after carefully investigating all the existing systems of embossed print, that Braille's system was superior for reading, writing, and printing, and it was adopted forthwith as the standard British embossed type.

5

In 1847, however, Dr. William Moon, a blind theologian of Brighton, England, had produced a hybrid system, based on alphabetical symbols but containing nine arbitrary signs. This system deserves some attention as it was the only one destined to persist besides that of Braille. Its so-called alphabetical symbols are rather suggestive outlines of Roman capitals than the letters themselves. All

4. Illingworth. History of the Education of the Blind, pp. 8-46.

5. Rutherford. William Moon and His Work for the Blind.

curves and small lines are omitted but the form of the letter is sufficiently clear to be easily recognizable. Nine letters of the Roman alphabet did not lend themselves to this denuding process, and to replace these, nine arbitrary signs were introduced, being however of so simple a nature as to be easily learned, and not confusing to the reader. The system can be read by the return line method, from left to right, and then back from right to left on the next line.

Moon's system has proved much more readable to the adult blind than Braille, a fact of which we shall have to speak later. This has mainly been responsible for its persistence in both Europe and America, since it is of great assistance in Home Teaching activities. It cannot, of course, be written as braille can, but it can be quite easily embossed through an invention of Moon's by which stereotyped plates may be produced.

Two modifications of Braille's point system which were developed in the United States remain to be described. These were New York Point and Modified Braille, later known as American Braille. Dr. John D. Russ, first superintendent of the New York Institution for the blind, was probably the inventor of New York Point,⁶ though Mr. William B. Wait, his

6. Sawyer. A Reviewer Reviewed and Some Errors of Statement Concerning Embossed Systems of Printing and Writing Corrected.

successor claimed the invention as his own. The chief features embodied in New York Point were: (1) space-saving and (2) ease of writing. The cells were two instead of three points high while the base of a character might be extended through any number of cells. The system was based upon the principle of frequency of recurrence, viz., the most frequently-used letters contained the fewest number of dots, and consequently occupied the least space. This fact also aided in ease and speed of writing with a frame and stylus.

This system was advocated so vigorously by Mr. Wait, that he succeeded in securing its adoption into many of the American schools for the blind. Braille had found its way into the country, and was being used at the Missouri school. The popularity of the system increased by leaps and bounds with the invention, in 1892, of a Braille writer and stereotype-maker, by means of which the writing and printing of braille was much simplified.⁷ In 1878 Mr. J. W. Smith had re-arranged the braille signs according to frequency of recurrence which had formed the basic principle of New York Point. In this system the most frequently used letters contained the fewest number of dots, and while it seems doubtful if actual space-saving in printing were achieved, it certainly in-

7. Hall. The Story of an Invention. The Mentor, 1893, pp. 68-73.

creased the ease of both machine and slate writing.

While American Braille gained some popularity, the champions of New York Point by no means gave up their cause. At the close of the nineteenth century, it was felt, however, that a universal system should be introduced if possible to enable an interchange of books, and thus widen the field of reading for the blind. The American Association of Workers for the Blind appointed in 1900, a Uniform Type Committee, which was to investigate the various systems of embossed print, and recommend one for universal adoption. In 1913, this Committee advocated a Standard Dot, a combination of the features of British Braille, American Braille and New York Point. This system, however, was never actually adopted, though the Instructors accepted it officially at their meeting the following year. The British refused to consider the new departure and the matter terminated by the adoption in 1917, of Revised Braille, which is essentially British Braille with fewer contractions, and a closer adherence to the usages of print.

Thus Braille and Moon Type are the only two systems of tangible typography which are now in general use in Europe and America. It is interesting to note in this connection that, of all the systems that have been produced, the sole survivors are those invented or perfected by blind men. One is inclined to agree with Armitage's dictum that, in matters of printing at least,

1871

1. The first of the year was a very cold day, with a heavy frost, and the wind from the north.

2. The second day was a little warmer, but still very cold, with a light frost.

3. The third day was a very warm day, with a heavy rain, and the wind from the south.

4. The fourth day was a very cold day, with a heavy frost, and the wind from the north.

5. The fifth day was a very warm day, with a heavy rain, and the wind from the south.

6. The sixth day was a very cold day, with a heavy frost, and the wind from the north.

7. The seventh day was a very warm day, with a heavy rain, and the wind from the south.

8. The eighth day was a very cold day, with a heavy frost, and the wind from the north.

9. The ninth day was a very warm day, with a heavy rain, and the wind from the south.

10. The tenth day was a very cold day, with a heavy frost, and the wind from the north.

11. The eleventh day was a very warm day, with a heavy rain, and the wind from the south.

12. The twelfth day was a very cold day, with a heavy frost, and the wind from the north.

13. The thirteenth day was a very warm day, with a heavy rain, and the wind from the south.

14. The fourteenth day was a very cold day, with a heavy frost, and the wind from the north.

15. The fifteenth day was a very warm day, with a heavy rain, and the wind from the south.

16. The sixteenth day was a very cold day, with a heavy frost, and the wind from the north.

17. The seventeenth day was a very warm day, with a heavy rain, and the wind from the south.

18. The eighteenth day was a very cold day, with a heavy frost, and the wind from the north.

19. The nineteenth day was a very warm day, with a heavy rain, and the wind from the south.

20. The twentieth day was a very cold day, with a heavy frost, and the wind from the north.

21. The twenty-first day was a very warm day, with a heavy rain, and the wind from the south.

22. The twenty-second day was a very cold day, with a heavy frost, and the wind from the north.

23. The twenty-third day was a very warm day, with a heavy rain, and the wind from the south.

24. The twenty-fourth day was a very cold day, with a heavy frost, and the wind from the north.

25. The twenty-fifth day was a very warm day, with a heavy rain, and the wind from the south.

26. The twenty-sixth day was a very cold day, with a heavy frost, and the wind from the north.

27. The twenty-seventh day was a very warm day, with a heavy rain, and the wind from the south.

28. The twenty-eighth day was a very cold day, with a heavy frost, and the wind from the north.

29. The twenty-ninth day was a very warm day, with a heavy rain, and the wind from the south.

30. The thirtieth day was a very cold day, with a heavy frost, and the wind from the north.

31. The thirty-first day was a very warm day, with a heavy rain, and the wind from the south.

the blind know what is best for their own use. It is difficult for those who do not read by means of the tactile sense to appreciate the qualities necessary to a satisfactory system of tangible print, and it is largely due to the recognition of this fact that advances in the field of embossed typography have been made.

Relative sensitivity of the blind and the seeing.

When a seeing person observes one who is blind reading by means of embossed print, he almost invariably remarks upon the "wonderful" sensitivity of touch displayed by the blind individual. Not only is it the popular notion that the blind possess a keener sense of touch than do the seeing, but it is believed, furthermore, that this superior tactile acuity is a direct and automatic result of blindness, requiring no training nor development.

About the middle of the nineteenth century,
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 Dr. Griesbach, a German scientist, became interested in the question of relative sensitivity of the blind and the seeing. Experiments which he performed with the two-point threshold and with other tests, showed that those without sight were not superior in physiol-

8. Fraser. The Psychology of the Blind. American Journal of Psychology, Vol. 28, pp. 229-37.

ogical sensitivity to the physically normal, but upon the whole, rather inferior. A more recent intensive experiment conducted by Dr. Seashore⁹ of the University of Iowa, with certain individuals from the Iowa College for the Blind, appeared to indicate that the findings of Griesbach were essentially correct.

If the results of these experiments may be accredited, they prove conclusively the current belief is entirely erroneous that the ability to read by touch is dependent upon superior physiological sensitivity. We must conclude, therefore, that tactile reading is not a peripheral, but rather a central psychological process and certain individual variations would seem to indicate furthermore that the process is based upon a specific psychic factor. This factor appears to be the capacity to associate tactile stimuli with symbols and meanings thus establishing a definite connection between touch sensations and intellectual processes. Whether a seeing individual can learn to employ touch in this manner is questionable. He undoubtedly has the latent capacity, but constant visual stimuli would act as a disturbing factor and prevent the establishment of the association just referred to.

9. Seashore and Ling. On the Comparative Sensitiveness of Blind and Seeing Persons. Psychological Monog. Vol. 25, No. 108, pp. 148-58.

Furthermore, he has become accustomed to associate visual sensations with symbols and meanings and, while continuing to do so, would find it difficult to change over to tactile imagery. It is even to be doubted if an adventitiously blind individual who has been accustomed to read by sight ever builds up the tactile imagery of one congenitally blind, though the former may learn to read quite easily by touch. Such an individual probably changes all tactile sensations into visual imagery before actual perception takes place. He would, if given sight, be able to read embossed print by vision, while one congenitally blind, if his sight were suddenly restored, would not recognize by vision the characters he once read fluently by touch.

Keeness of sensation is apparently not then, the chief requirement for tactile reading. One blind
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 writer on this subject claims to have a discernible callous on the tip of his left forefinger which is that commonly employed in reading. Yet he could not read with his third or fourth fingers, though these would prove more highly sensitive, if the two-point threshold test were applied. Perceptual keenness is rather to be considered as the basis of this capacity, which does not imply the existence of a

10. Swift. The Unknown Folk (Unpublished Essay).

"sixth sense" but simply the use of sensations experienced by every individual. There is nothing marvelous about it as it is simply a further illustration of James' thesis in the "Energies of Men," viz., that men only use a fraction of their potential energies which might be used to advantage under proper conditions.

Why Moon is more readable to the adult blind than braille

In the light of the foregoing discussion of relative sensitivity showing the essentially psychological nature of the process of tactile reading, let us now attempt to answer the question why Moon type is more readable to the adult blind than braille. In our analysis of the two systems we endeavored to show that while braille was entirely arbitrary, Moon type contained only nine unconventional signs. The fact was also mentioned that the braille point possessed superior tangible qualities to the embossed line.

Now it is popularly supposed that the adult blind, whose fingers have been calloused with toil, find it easier to perceive the Moon than the braille characters,¹¹ yet, if points are more tangible than lines, this contention seems hardly justifiable. An instance has also been cited to show that calloused

11. Best. Op. Cit. Ch. 26, p. 402.

fingers do not interfere with the ability to read braille if the system were mastered in early life.

A more plausible explanation is that based upon differences in imagery. The older adventitiously blind, find it difficult to translate tactile stimuli into visual images when the system used is of a wholly arbitrary nature. Moon Type is large and highly tangible for a line system, but above all, it is based for the most part upon conventional alphabetical symbols, so that the adult reader has only to master a few simple arbitrary signs before he can read. It is not the inferior tangibility of braille that makes it difficult for the adult reader. It is its complexity and arbitrariness which stand out clearly when compared with the simplicity of Moon Type.

This accounts also for the fact that many adult blind first learn to read Moon Type and later master braille. It is not due to an increase of physiological sensitivity but to the fact that, having become accustomed to interpret tactile sensations as visual images and, ^tassociate these images with meanings, they find it possible to master a more complex and arbitrary system of symbolization. Thus the assumption that tactile reading is essentially psychological in its nature, is borne out by an examination of the comparative legibility of braille and Moon Type in the case of the adult blind, and furthermore, these facts are more satisfactorily explained by this hypothesis than by the belief that toil-hardened fingers cannot

learn to sense the braille points.

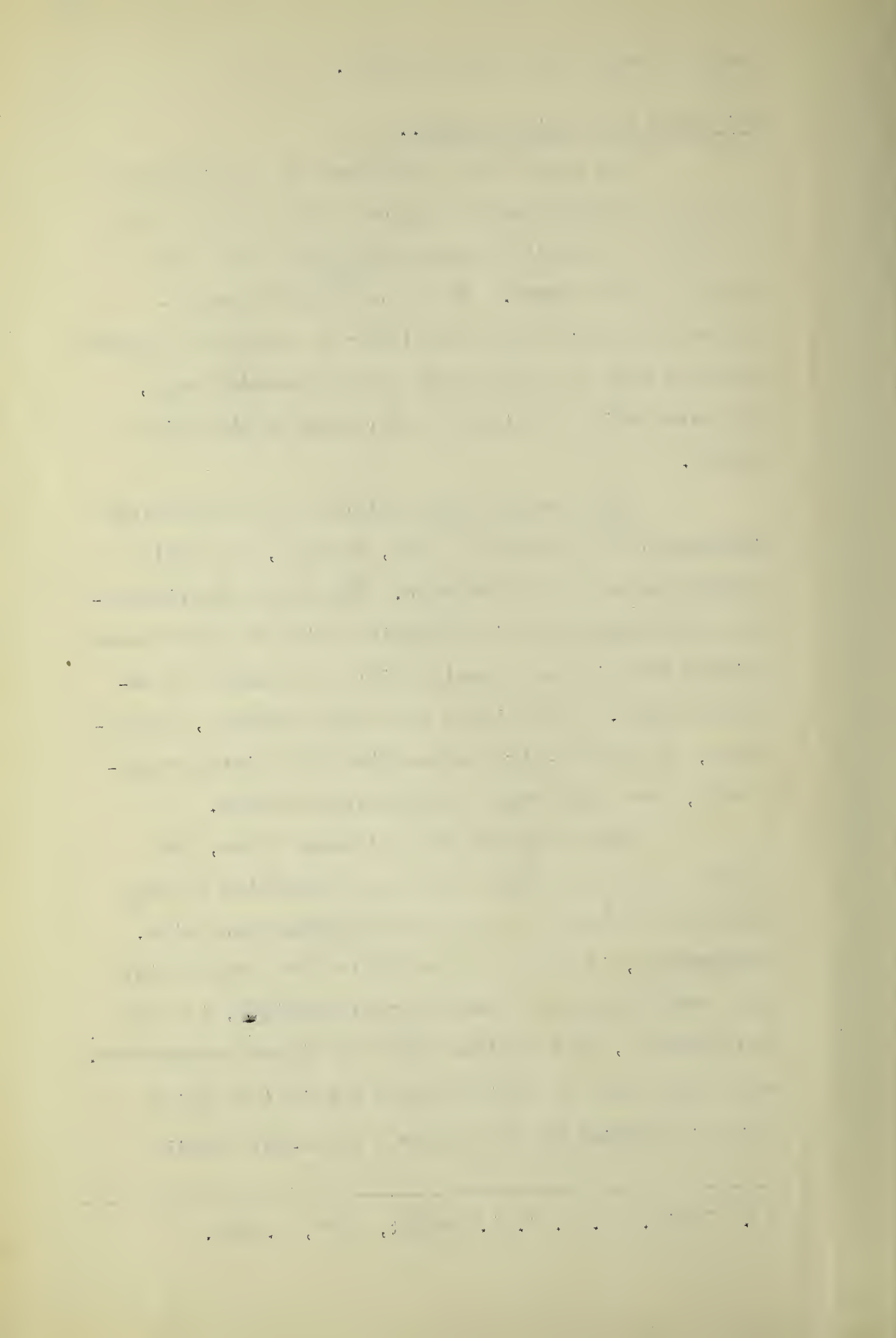
Height of the braille point..

The belief has long been held by publishers of braille books that the highest points which might be embossed without breaking the paper were most legible to the touch. It was concluded from empirical reasoning that the higher an embossed character could be made to stand above the surrounding page, the more easily it might be discerned by the blind reader.

Experimental data collected by the American
12
Foundation for the Blind show, however, that this conclusion has been erroneous. Extensive experimentation was carried out to determine which of three given heights of point were most legible to readers of embossed print. The heights used were eighteen, twenty-three, and twenty-five thousandths of an inch respectively, measuring from the stereotyped plate.

Results showed that of these three, the middle height was read with greater facility by the majority of those on whom the experiment was tried. Furthermore, it appeared that while the lowest point was read less easily than the medium height, it was nevertheless, more legible than the highest characters. This would seem to indicate that a height of point which is sufficient to produce a clear-cut tactile

12. Irwin. A. A. W. B. Report, 1927, p. 151.



impression, and yet is not so high as to raise the finger-tip from the surrounding page, proves most suitable for tactile reading.

The explanation which has been offered for this phenomenon is that the higher and lower points produce greater nervous fatigue in the reader than does the medium height. The former tends to weary the touch receptors in the finger-tips, while the latter requires greater concentration of attention. While fatigue undoubtedly has some bearing on the question, it is interesting to observe that the new Gestalt theory¹³ of perception assists further in solving the problem.

In dealing with the phenomena of vision, this theory asserts that perception of an object cannot take place without the accompanying background. If this theory may be applied to tactile as well as to visual perception, it explains why the finger-tip, while resting on the braille points, must also come in contact with the surrounding page. While the validity of the Gestalt theory has been questioned, and while our application of it to tactile sensation may not be entirely justifiable, it undoubtedly helps to explain the findings of the American Foundation as to the most readable height of braille point.

13. Psychologies of 1925. Ch. 8.

The "word vs. the "letter" method of teaching braille.

There has recently been some discussion regarding the advisability of teaching primary braille reading by the "word" or by the "letter" method. By the former method the child is taught to recognize simple words denoting familiar objects, and is gradually inducted into more and more difficult tasks until his vocabulary is sufficiently large for simple reading exercises. In the latter case, the child is first taught all the alphabetical symbols and thence the process of word-building.

While the "word" method has found much favor in schools for the seeing because of its greater rapidity, the majority of institutions and day school classes for the blind employ the "letter" method for teaching braille.¹⁴ This is probably due to the fact that the "word" method does not, in certain respects, easily lend itself to the teaching of tactile reading. In visual reading, the whole word can be perceived by the child as a single visual stimulus while in reading by touch, only one character at a time can be covered, and the word is perceived as a series of tactile stimuli. This discrepancy between visual and tactile perception renders the word method less applicable to blind than to seeing children though it may not, of course, be entirely unsuited to the instruction of

14. Maxfield. On the Present Status of Primary Reading in Institutions and Day School Classes for the Blind

those without vision.

A carefully controlled experiment with blind children just beginning to learn braille would throw some definite light upon this particular question. Two groups should be selected, matched as far as possible in chronological age, mental ability, manual dexterity, etc., one being taught to read by the "word" the other by the "letter" method. The group which made the greatest progress over a given period of time would indicate that the method employed in its instruction was the more satisfactory of the two. While from a purely empirical standpoint, it would appear that the "letter" method is best suited to the teaching of braille, experiment might prove the exact opposite to be the case. As we have already seen regarding the proper height of point, empirical judgments on the subject of tactile reading not infrequently lead to incorrect assumptions.

Conclusions.

In concluding the present brief discussion of certain factors involved in tactile reading, the following points may be noted.

1. The arbitrary and semi-arbitrary systems of embossed print have been preferred to the alphabetical systems.
2. The two surviving systems have been those invented or perfected by blind men, illustrating that the blind are better judges than the seeing as to the

most suitable form of tangible type.

3. Since the blind appear to possess no superior physiological sensitivity we conclude that tactile reading is a central psychological, rather than a peripheral physiological process.

4. Moon type is more readable to the adult blind than braille, not because of the inferior tangibility of the latter, but because of its complexity of structure and complete arbitrariness as compared with the greater simplicity and conventionality of the former.

5. Experiments show that a medium height of point is preferable to one very high or very low. This may be partially explained by increase of fatigue and partly by the application of the Gestalt theory of perception.

6. The suitability of the "word" method of teaching braille probably depends upon whether a series of tactile stimuli may be as easily perceived as a complete visual stimulus. A carefully controlled experiment is necessary to decide this point.

